Presentation To
RMRA Peer Panel
Day #1

Preferred Option and Risk Assessment

August 25, 2009

Development of the Preferred Option and Implementation Plan
Results of Initial Screening

- **Route screening eliminations:**
  - North of Fort Collins, South of Pueblo due to inadequate demand.
  - West of Eagle due to high development cost with insufficient cost benefits.

- **Technology screening eliminations:**
  - Eliminate 79-mph diesel on Existing Rail.
    - Operating subsidy, negative cost benefit, low market penetration.
  - Eliminate 110-mph diesel on Existing Rail.
    - Could possibly work in I-25, but cannot go up I-70 mountain corridor.
    - An incremental rail solution has been suggested west of Eagle, but its evaluation was not funded within current RMRA project scope.
  - Eliminate Maglev options.
    - Maglev options have very high capital cost and produce marginal or negative cost benefit ratios.

Retained Options

- **Focus on Core System:**
  - I-70 DIA to Eagle Airport
  - I-25 Fort Collins to Pueblo

- **Retain Double-Track Electric Rail Option**
  - High powered electric trains are needed for I-70 mountain corridor; given the capabilities of the trains, greenfield alignments give the best performance because of better geometry and stations.
  - Existing rail ROW constrains performance of electric trains leading to recommendation for greenfields.
  - The analysis has assumed that FRA Compliant trains would be used to retain the capability for right-of-way sharing if needed.
  - Short segments of existing rail right-of-way may be needed for downtown access in urban areas (Denver and Colorado Springs) and west of Minturn (or Pando) to Eagle Airport.
RMRA Preferred Option: Electric Rail

Uses greenfields except for short segments of shared rail ROW in urban areas and west of Pando

RMRA Implementation Plan

Phases 1 & 2

**PHASE 1**
- Denver
- DIA
- Colorado Springs

**PHASE 2**
- Copper Mt.
- Breckenridge
- Colorado Springs
- Denver
- DIA

**PHASE 1: Capital Costs**
- 1-29: $2.65 Billion
- 2-79: $1.5 Billion
- Vehicles: $0.6 Billion
- TOTAL: $4.73 Billion

Capital Needed for Phase 1: $4.73 Billion

**PHASE 2: Capital Costs**
- 1-29: $2.0 Billion
- 2-79: $0.2 Billion
- Vehicles: $1.2 Billion
- TOTAL: $3.4 Billion

Capital Needed for Phase 2: $3.4 Billion
RMRA Recommended Routes
Phases 3 & 4

PHASE 3

Fort Collins
Copper Mt.
Breckenridge
Colorado Springs
Pueblo

PHASE 4

Fort Collins
Copper Mt.
Eagle Apt.
Breckenridge
Colorado Springs
Pueblo

PHASE 3: Capital Costs
1-25: $3.56 Billion
1-70: $9.02 Billion
Vehicle: 2.00 Billion
TOTAL: $14.58 Billion
Capital Needed for Phase 3: $4.10 Billion

PHASE 4: Capital Costs
1-25: $1.96 Billion
1-70: $12.97 Billion
Vehicle: 2.20 Billion
TOTAL: $21.13 Billion
Capital Needed for Phase 4: $9.15 Billion

Key to Operations
- Construction
- Design/Build
- Operations
- Maintenance
- Administration

Preliminary Implementation Plan for the RMRA Preferred Alternative

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Total Investment

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### Financial and Economic Performance of the Preferred Alternative

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<td><strong>COST BENEFIT RATIO</strong> (Total Benefits / Total Cost)</td>
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Freight Railroad Risk Analysis

- Performed a Risk Analysis on use of Freight Rail Right of Way
  - Bypass alternative via E-470
  - Elevated alternative over existing rail

- The analysis was conducted as a Sensitivity to the double-track Electric Rail Preferred Option based on a fully built-out system

Risk Analysis Parameters
- Capital Costs Range: Low to High
- Bypass Speed Range: Slow to Fast
- Compliant vs. Non-Compliant Equipment: Capital and Operating Cost

Risk Analysis Routes

I-25 North

I-25 South

Downtown Station moved East

Two Added Stations
**Risk Analysis Routes**

**I-70 West**

**Legend**
- Greenfield Option
- Preferred Option
- Bypass Option
- Common Route

Greenfield Option developed from Pando to Eagle

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**Risk Analysis Segments Summary**

- **East Corridor from Denver to I-70/E-470 Interchange to DIA**
  - Continues to I-25 North, replacing the use of BNSF Brush Line

- **E-470 from Lone Tree to I-70/E-470 Interchange**
  - Replaces use of Joint Line from the South

- **Greenfield from Pando to Eagle Airport**
  - Eliminates use of UP Tennessee Pass Rail Line

- **Greenfield around Colorado Springs**
  - Bypasses the Joint Line through downtown Colorado Springs

- **Elevated Structures on Joint Line and Brush Line**
  - Stays on existing rail ROW, but provides vertical separation in areas where there is insufficient lateral clearance
BNSF Meeting on August 20, 2009

- BNSF Reviewed the Joint Line sharing plan presented to the Committee on Feb 27, 2009 and agreed to the feasibility of adding at-grade tracks in the Joint and Brush Line corridors.
- They felt the plan was a reasonable starting point, and saw value in the additional separation this plan would provide between freight and LRT operations.
- BNSF recommended next step: Preliminary Engineering and Detailed Capacity Analysis to be conducted by BNSF.
**Risk Analysis Routes**

**OPTION 1:** Elevated Option over Existing Rail through Denver (same alignment as the Preferred Option)

**OPTION 2:** Bypass Option uses E-470 around Denver and I-70 corridor to east

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**Time and Mileage Comparisons**

**Risk Analysis Options: to/from I-25 North Stations**

<table>
<thead>
<tr>
<th>Segment</th>
<th>Preferred and OPT 1 Elevated</th>
<th>OPT 2 Bypass (60mph)*</th>
<th>OPT 2 Bypass (90mph)*</th>
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<tr>
<td></td>
<td>Travel Time (min)</td>
<td>Distance (miles)</td>
<td>Avg Speed (Mph)</td>
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<tr>
<td>North Suburban - Denver</td>
<td>14</td>
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<td>13</td>
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<td>North Suburban - DIA</td>
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<td>Lone Tree - Denver</td>
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<td>Lone Tree - North Suburban</td>
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<td>104</td>
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<tr>
<td>Pueblo-Lone Tree</td>
<td>59</td>
<td>98</td>
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**Risk Analysis Options: to/from I-25 South Stations**

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<tr>
<th>Segment</th>
<th>Preferred and OPT 1 Elevated</th>
<th>OPT 2 Bypass (60mph)*</th>
<th>OPT 2 Bypass (90mph)*</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Travel Time (min)</td>
<td>Distance (miles)</td>
<td>Avg Speed (Mph)</td>
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<tr>
<td>Lone Tree - Denver</td>
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<tr>
<td>Pueblo-Lone Tree</td>
<td>59</td>
<td>98</td>
<td>100</td>
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**KEY**
- Better
- Worse

*Because we do not have geometry for the E-470 Bypass, two different options were developed as sensitivities on Average Commercial Speed (with stops) of 60-mph and 90-mph*
Ridership and Revenue Performance
Risk Analysis Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Ridership</th>
<th>Ridership % of Pref Alt</th>
<th>Consumer Surplus ($mill)</th>
<th>Rev ($mill)</th>
<th>Passenger miles (Mill)</th>
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<tr>
<td>Preferred and OPT 1 Elevated</td>
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<td>$811.57</td>
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<td>OPT 2 Bypass (60-mph)</td>
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<td>$758.68</td>
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<td>OPT 2 Bypass (90-mph)</td>
<td>35,504,284</td>
<td>104%</td>
<td>$866.46</td>
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Bypass options:
- Regardless of speed, the Bypass worsens I-70 and downtown Denver connectivity from I-25 both North and South
- However, it puts DIA directly on the I-25 North corridor, and adds a strong Aurora station at the I-70 / I-225 Junction
- Net Impact:
  - A 60-mph bypass worsens ridership due to added time.
  - A 90-mph bypass improves ridership due to added Peoria Street/Smith Road station and better DIA connectivity.

Specific Corridor Ridership Impacts

<table>
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<tr>
<th>Option</th>
<th>I-70 West</th>
<th>I-25 North</th>
<th>I-25 South</th>
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<td>OPT 2 Bypass (60-mph)</td>
<td>90%</td>
<td>110%</td>
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<td>OPT 2 Bypass (90-mph)</td>
<td>96%</td>
<td>124%</td>
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- I-25 North corridor: **Positive**
  - DIA Airport connectivity and the Peoria Street / Smith Road station
  - Ridership improves even for the 60-mph bypass

- I-25 South corridor: **Mixed**
  - 60-mph Bypass degrades ridership in spite of new stations.
  - 90-mph Bypass improves ridership

- I-70 corridor: **Negative**
  - Bypass options degrade connecting ridership

- Overall: **Depends on the Speed of the Bypass**
Colorado Springs Greenfield Impact

- The Colorado Springs downtown station was moved to a suburban location along US-24 in Cimarron hills on US-24
  - The proposed South Colorado Springs stop in fountain was retained, on the greenfield alignment it is very close to the Colorado Springs airport
  - Access to some zones that formerly associated with the downtown station are now more convenient to the South Colorado Springs (airport) station
  - As a result, traffic at South Colorado Springs (the airport) increased in the bypass option while the Colorado Springs East stop (relocated downtown station) decreased

- With two station stops, the greenfield alignment around Colorado Springs saves 6 miles and 8 minutes compared to the downtown route, resulting in faster service to all points north

- Since trains to Denver are faster than before and because of the zone reallocation, *shifting the downtown station to the suburban location did not harm total ridership at Colorado Springs*
Impact of Non Compliant Equipment on Cost Benefit Ratio

Capital NPV: 72% of Total
Capital Savings:
- 30% of Equipment
- 2.5% of overall Capital Cost
- 1.8% of Total Cost NPV

Operating NPV: 28% of Total
Operating Savings:
- 10% of Fuel and Equipment Maintenance
- 3.7% of overall Operating Cost
- 1.1% of Total Cost NPV

Overall NPV Impact: 2.9%
- 1.8% Capital Savings
- 1.1% Operating Savings

Risk Analysis: Cost Benefit Ranges

- Best Case – Low Capital Costs, with Non Compliant Equipment
- Worst Case – High Capital Costs, with Compliant Equipment
Since we do not have geometry for the E-470 bypass, we need to combine the ranges for the two speeds. The cost benefit ratio could range from 1.14 up to 1.40 depending on the final configuration.
Risk Analysis Conclusions

- The downside risk is 6-23% on the Cost Benefit ratio. All the Risk Options are still viable, but they produce lower Cost Benefit ratios than the original Preferred Option.

- Station issues to be further examined in future studies:
  - Routing the DIA Airport line via Peoria Street / Smith Road station would be a definite plus, but its feasibility depends on resolving potential ROW conflicts with UPRR and the RTD East Corridor.
  - Through routing service via DIA is beneficial to the I-25 North corridor, but if the airport terminal is not served directly, this gain must be traded off against any detrimental impact on DIA airport ridership and revenue.
  - An east suburban Colorado Springs station in conjunction with the greenfield option maintains ridership.

- If E-470 rail can be built with good geometry, and if access can be gained from E-470 / I-70 to downtown Denver at a reasonable cost, then the E-470 Bypass option could work.

Thank You.
I-25 North – “Milliken” vs I-25 Greenfield

I-25 South – “Joint Line” vs Greenfield

* Greenfield Preferred
I-70 West – I-70 ROW vs Unconstrained

LEGEND
- Greenfield Constrained
- Greenfield Unconstrained
- Existing Rail
- Western Cut-Offs

“Western Cut Offs” are too expensive
Ridership is not sufficient to support development of Double Track Electric Rail west of Eagle Apt.